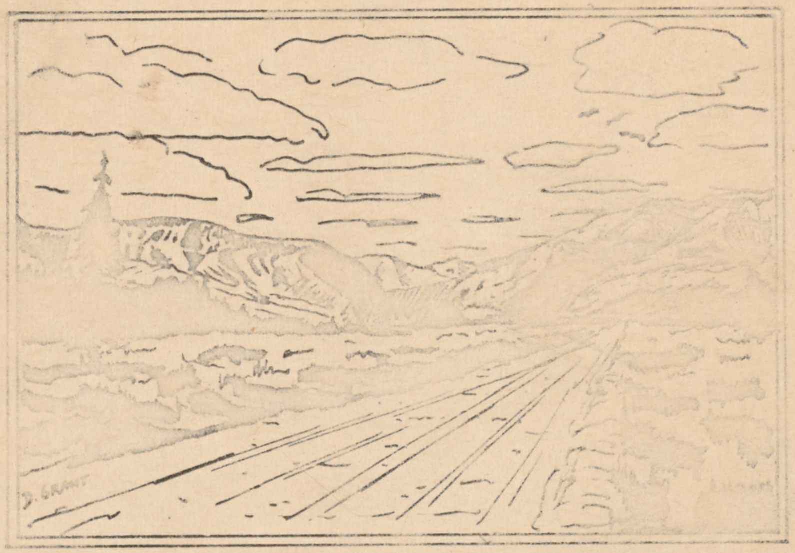
C.R. Stelck

EDMONTON GEOLOGICAL SOCIETY

1959 FIELD TRIP
GUIDE BOOK



CADOMIN AREA

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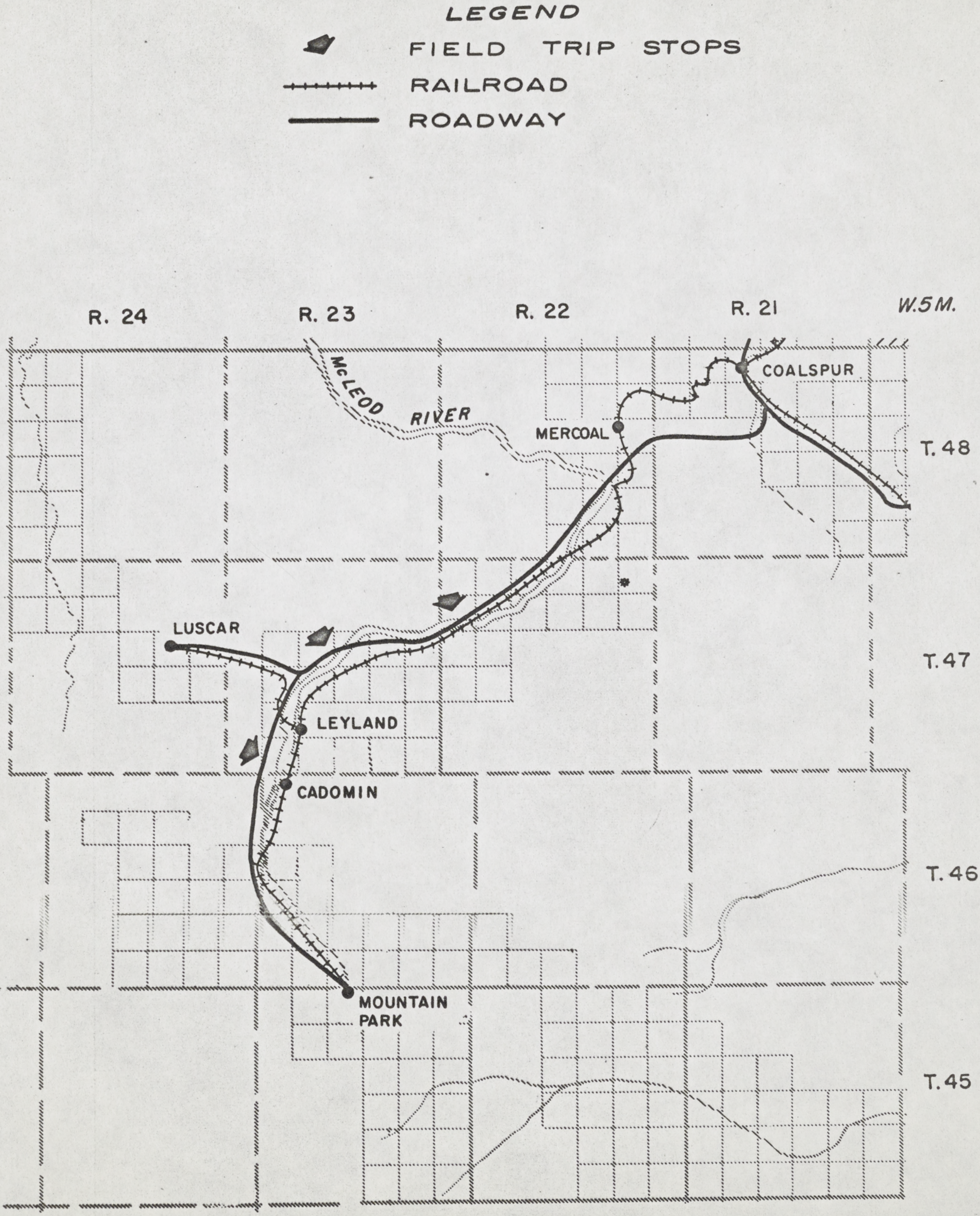

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CADOMIN AREA 1959
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LEGEND

Tp Te Kbz Ke Kbr	PASKAPOO EMBARRAS BRAZEAU (EDMONTON BELLY RIVER)
Kw Ks Kc Kbl Kk Kd Ksh	WAPIABI (SOLOMON) CARDIUM BLACKSTONE (KASKAPAU DUNVEGAN SHAFTESBURY)
Kb Kmp Kl Kcd	BLAIRMORE (MOUNTAIN PARK LUSCAR) CADOMIN
Kn Jf	NIKANASSIN FERNIE
$\bar{R}$w $\bar{R}$s	WHITEHORSE SPRAY RIVER
Prm Mr Mb	ROCKY MOUNTAIN RUNDLE BANFF
Dp Df	PALLISER FAIRHOLME

R. 24 R. 23 R. 22 R. 21 W.5M.

T. 48

T. 47

T. 46

T. 45

T. 30.198

GENERAL STRATIGRAPHIC SECTION IN CADOMIN AREA

ERA	SYSTEM	SERIES OR GROUP	FORMATION		THICKNESS	LITHOLOGY
	TERTIARY	PALEOCENE	PASKAPOO			Coarse, brown weathering sandstones. Conglomerates, and earthy shales.
			ENTRANCE CONGLOMERATE			
MESOZOIC	CRETACEOUS — UPPER CRETACEOUS	MONTANA	BRAZEAU — UPPER EDMONTON		9,000'	KNEE HILLS TUFF
			BRAZEAU — MID & LOWER EDMONTON		–	Sandstone, soft, friable, green and grey - abundant cross-bedding. Several greenish-grey shales and numerous cool seams. Some massive beds - chert and quartz pebble conglomerate.
			BRAZEAU — BELLY RIVER		11,000'	
			BRAZEAU — SOLOMON		100'	Light, greenish-grey, glauconitic sandstone.
			WAPIABI		1,700'	Black marine shale - several thin calcareous beds. Some layers of which contain large ironstone concretions.
		COLORADO	CARDIUM		300'	Marine and fresh water, brown, fine-grained sandstone alternating with grey and black shales. Chert cgliat top.
			BLACKSTONE		1,500'	Black fissile marine shale with lenses of impure limestone and ironstone concretions.
						FISH SCALES
	CRETACEOUS — LOWER CRETACEOUS		GRIT			
			MOUNTAIN PARK		400'	Hard, rusty-brown weathering, coarse, cross-bedded sandstone and olive green sandy shale and lenses of rusty-red weathering conglomerate, composed largely of small black chert pebbles.
			LUSCAR		1,700'	Soft, grey sandstone and carbonaceous grey shales, several conglomerate lenses. Contains all the lower cretaceous commercial cool seams of the district.
			CADOMIN		35'	Massive, resistant, light-colored conglomerate, composed of chert and quartzite pebbles cemented in a siliceous matrix.
	JURASSIC		NIKANASSIN		1,600'	Sandstone, fine-grained, brown weathering, and dark grey shale with thin impure coal seams.
			FERNIE — UPPER FERNIE			Black, marine, fissile, shales. Sandstone, fine-grained, quartzitig. Black chert and quartz pebble conglomerate.
			FERNIE — ROCK CREEK		1,300'	
			FERNIE — NORDEGG			
	TRIASSIC		WHITEHORSE		280'	Dolomite, whitish-grey weathering, argillaceous, fine-grained - several beds of dolomitic sandstone.
			SULPHUR MOUNTAIN — U. SILTSTONE			Siltstones, reddish grey weathering, thin bedded, argillaceous. Dolomite, light colored, silty, medium crystalline, porous.
			SULPHUR MOUNTAIN — M. DOLOMITE		645'	
			SULPHUR MOUNTAIN — L. SILTSTONE			
	PERMO PENN		ROCKY MOUNTAIN	Q	25'	
PALEOZOIC	MISSISSIPPIAN	RUNDLE	MOUNT HEAD		265'	Dolomite, light brown-grey, medium crystalline, minor shale partings. Porous in part.
			TURNER VALLEY		180'	Dolomite, light grey, medium-grained, porous, numerous, cup and colonial corals crinoid stems.
			SHUNDA		300'	Dolomite, medium brown-grey, oolitic in part, silty, calcareous. Solutions breccias.
			PEKISKO		115'	Dolomite, light grey, medium crystalline. Some cup corals.
		BANFF	UPPER		575'	Interbedded dark brown grey calcareous shale and argillaceous limestone. Limestone increases towards the top of the formation.
			LOWER			
			EXSHAW		20'	Shale, dark grey, ochre yellow and red weathering.
	DEVONIAN		PALLISER		700'	Limestone, fine-grained, massive, grey color, fucoidal weathering.
			ALEXO		250'	Buff weathering, silty dolomite, siltstone and limestone.
		FAIRHOLME	SOUTHESK — NISKU		300'	Southesk - Dolomite, light grey, fine to coarse crystalline, coral beds in upper part. Nisku - limestone, dark grey. Mt. Hawk - shale with nodular limestone interbedded, dark grey and olive.
			SOUTHESK — MT HAWK			
			CAIRN — PERDRIX		600'	Cairn - Dolomite, dark grey, fine crystalline, organic, stromatoporoids, amphipora. Perdrix - Shale, black, calcareous.
			FLUME		200'	Flume - Dolomite, dark grey, fine crystalline, stromatoporoids.
	CAMBRIAN				250'	Dolomite, grey, weathering grey and buff, fine to medium, silty, some siltstone.
					100' +	Limestone, dark grey, intraformational conglomerates, alternating with shale, olive grey.

LEGEND

- DOLOMITE
- LIMESTONE
- SANDSTONE
- SILTSTONE
- MASSIVE CHERT
- CONGLOMERATE
- Q QUARTZITE
- SHALE

General Surface Structure

The rocks in the foothills belt have been deformed by mountain building forces and occur as a series of folds and faults with a general N. 60° W. strike. The deformation increases from east to west across strike. The outer foothills belt has relatively open folds, while in the inner foothills the folds are more closed and a greater amount of faulting has taken place. The increased deformation to the west culminates in the overthrusting of Paleozoic strata, usually onto Upper Cretaceous.

Occasionally these thrust faults bring Paleozoic strata to the surface as isolated units, surrounded by Mesozoic formations. These isolated blocks have been referred to as outliers or inliers. The Nikanassin range in the Cadomin area is one of these outliers.

The Alberta Syncline lies to the east of the outer foothills. This is a broad low lying syncline devoid of topographic highs and for the most part densely wooded and muskeg covered. The easternmost fold of the foothills is considered to be the Coalspur anticline (Mile 43.3 on road log, top right corner of Geological map). Belly River sediments occupy the crestal part of this anticline. This anticline can be traced southeasterly to the Stolberg anticline and northwesterly to the Entrance anticline. This distance is well over one hundred miles. Immediately to the west is a broad syncline which has Tertiary sediments preserved in the axis.

Coalspur on the east side and Mercoal on the west side of this syncline both produce coal from the Tertiary. West of this syncline and separated from it by a narrow faulted anticlinal area there is another syncline containing Tertiary sediments. These are the most westerly preserved Tertiary sediments. The deformation westward from this second syncline becomes more severe and the beds exposed are older in each upthrust section. Finally the Paleozoics are thrust up in the Nikanassin range.

ROAD LOG

0	Highway 16 and Edson main street intersection.
6.2	Left turn to Cadomin.
26.7	R. R. Crossing.
30.2	View - Rocky Mts. in background, Nikanassin range in foreground.
40.0	R. R.
40.2	Bryan Hotel on left.
40.3	Bridge below Hotel over Bryan Creek.
40.8	Strip mine on left across valley.
41.8	Robb R. R. Station on left.
42.2	Belly River Ss. outcrop on right.
43.0	Bridge
43.1	Embarras R. on left.
43.2	Belly River outcrop on right. Dip N.E. 30° strike N. 60° W.
43.3	Centre of Coalspur anticline.
43.4	Belly River on right. Dip S.W. 12°.
43.7	Bridge over Embarras R. Edmonton on right dip S.W. 48°.
43.9	Edmonton on left in R. R. Cut.
44.25	Edmonton Ss. on right along Embarras River. Dip S.W. 62° strike N. 50° W. Ss. with quartzite cobble conglomerate at base of falls. Stop #1
44.4	Dip slope on right.
44.6	Bridge over Embarras. Coalspur on left.
44.9	Scattered Tertiary outcrop along roadside on right dipping S.W.
45.15	R. R. Crossing.
45.2	Bridge over Creek - Coalspur Pit straight ahead. Bituminous High volatile C - Non coking coal. Prod. 1938 350,000 tons; 1946 830,000 tons; 1953 636,000 tons. Est. reserves - 3,600 million tons.
45.9	Bridge over Embarras R.

46.1 Foothills road turn-off on left. Bridge over Embarras R. West dipping tertiary Ss. on right. On east flank of syncline. Turn off to B.A. Mt. Park, Lovett River & Coalspur wells.

49.3 Tertiary outcrop on right.

49.5 View of Nikanassin Range in background. Luscar Mt. on left. Devonian (Palliser - Alexo, Mt. Hawk, Perdrix thrust over Rundle). Rundle is exposed on two sides of an overturned anticline (east limb overturned). Banff shale exposed in centre of anticline.

50.85 Mercoal corner. Water tower on left.

51.2 East dipping beds near Tertiary - Edmonton contact. Entrance cong. at base is believed to be same as at Mile 44.25. Dip 42° S.E. Strike N. 48 W.

52.3 Bridge over R. R.

52.75-95 East dipping Edmonton on right Dip 80° N.E. Strike N. 50° W.

52.95 Bridge over McLeod R.

54.5 View of Nikanassin Range - McKenzie Gap on left.

58.1 View of Nikanassin Range. Leyland Mt. on left with Devonian faulted over Triassic. Luscar Mt. straight ahead. Photo 3.

58.95 B.A. Kaydee to right.

59.2 Bridge over McLeod R. Kbr. outcropping on the right along river.

59.7 Cardium formation on McLeod R. at right, not visible from road. Stop #2.

60.5 Outcrop in R. R. on left.

62.6 Luscar Mt. in foreground.

62.9 Bridge over McLeod R. - Kbr. and cong. Ss. on left side in river bank.

63.3 Saw Mill. Trail at far left side of sawmill yard leads to lower Belly River strata on the river. The transition beds and Soloman Ss. can be seen upstream from this outcrop. These beds are over-turned. Photo 5 Basal Belly River. Stop #3.

63.7 Leyland Mt. straight ahead.

64.15 Bridge across Luscar Creek.

64.3 Cardium Ss. on right. Ss. are faulted and repeated.

64.5 Cardium Blackstone contact on right. Photo 4.

65.0 Turn right to Luscar.

65.8 McLeod Gap straight ahead. Cheviot Mt. on the front range in centre background. Cadomin Mt. on left. Leyland Mt. on right. Photo 1.

66.2 Leyland Station turn-off on left. R. R. Crossing.

66.9 Cadomin general store on left.

67.1 Blackstone - Mt. Park contact on left in R. R. cut. Stop #4.

67.1 Mt. Park Ss. on right.

67.3 Luscar formation along R. R. track on left, also on road cut right.

67.7 Addit and shaft on right - figures for Mt. Park area. Medium and low volatile bituminous coal.

1938 688,000 tons
1949 1,128,000 tons
1953 482,000 tons. Estimated reserves, 5,200 million tons.

67.8 Luscar on R. R. disturbed.
Cadomin
Nikanassin

68.6 Lms. quarry in Palliser on right.

68.7 Palliser on right.

68.8 Banff on right.

69.0 Rundle on right.

69.1 Near fault trace - Devonian faulted onto Rundle.

69.2 Alexo on right.

69.3-4 Palliser on right.

69.5 Banff in valley on right. Mt. composed of Rundle formation.

69.9 Rundle on mountain on left. Photo 2.

70.2 Bridge over Whitehorse Creek.

70.6 Triassic on right.

71.7 Fernie shale on right.

71.8 Bridge.

72.1 Nik.-Fernie contact on left.

73.2 R. R. Ripple marked Nikanassin on left.

73.8 Cadomin - Nikanassin contact on left.

74.3 Cadomin dip slope on left.

74.5 Luscar on left.

75.8 Mt. Park R. R. Station on left. There are 8 seams of commercial coal aggregating 77' of coal in a 1200' interval.

77.9 McLeod River - Blackstone on left.

78.3 Cardium Ss. on left.

79.4 Divide between McLeod and Cardinal Rivers. Stop #5.

PHOTO 1

McLEOD GAP - NIKANASSIN RANGE IN FOREGROUND
LEYLAND MT. ON RIGHT. CHEVIOT MT.
OF THE FRONT RANGE IN BACKGROUND

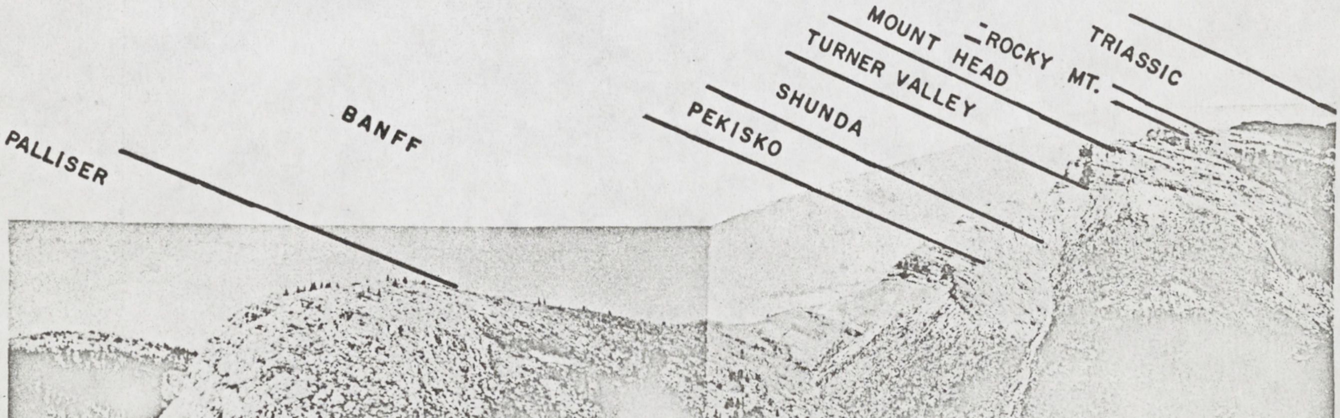

PHOTO 2

VIEW OF NIKANASSIN RANGE. LOOKING EAST FROM
ROAD THROUGH McLEOD RIVER GAP

PHOTO 3

NIKANASSIN RANGE. LEYLAND MT. ON LEFT - LUSCAR MT. ON RIGHT

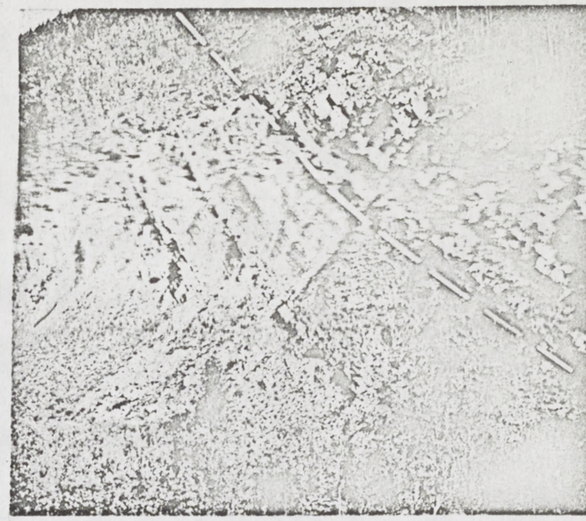

PHOTO 4

CARDIUM - BLACKSTONE CONTACT MILE 64.5 ON ROAD LOG

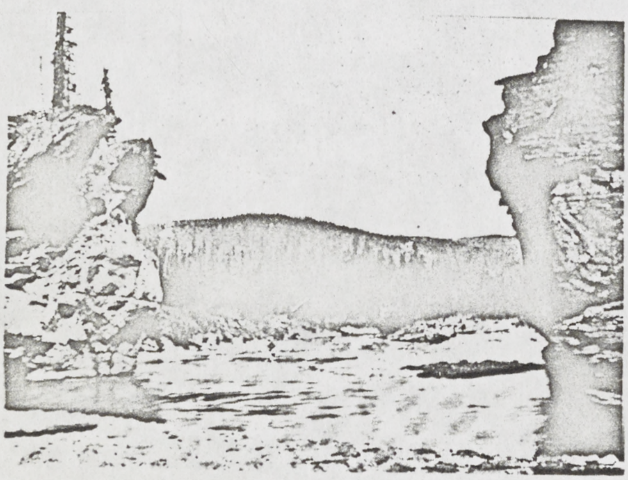

PHOTO 5

BASAL BELLY RIVER AT "HELLS GATE" IN SEC. 22, TWP. 47, RGE. 23, W.5M

PHOTO 6

MISSISSIPPIAN - PERMO-PENN-TRIASSIC CONTACTS, ALONG R.R. CUT S.W. OF McLEOD R. - WHITEHORSE R. CONFLUENCE

SHORT HISTORY OF THE CADOMIN AREA

P. S. Warren - Professor Emeritus
University of Alberta

Coal was mined first at Coalspur when a branch line of the Canadian National was built south from Edson (Bickerdike Junction). Later the line was extended to Mountain Park Collieries bypassing the Cadomin coal seam which had not been exploited at that time. It was, however, quickly staked by another company and rapidly became the most prolific mine of the area. Luscar was opened up later by the Mountain Park Collieries.

The history of the exploration of the Cadomin is interesting. It was first opened on the south bank of the McLeod river beside the railway to Mountain Park. Mining was a simple matter as they merely had to drive straight in on the coal seam. After advancing about a mile and a half the mine caught fire. They then drove in on the north side across the river but after advancing about a mile and a half the mine again caught fire. This catastrophe appeared to end the Cadomin mine but a suggestion to bypass the fire by driving a rock tunnel through the heavy sandstone (Home Sand) below the coal seam was made and acted upon and once more the mine was in operation but again it caught on fire and had to be abandoned. The company then turned their attention to the south side (the original mine) and drove a rock tunnel in below the seam and operations resumed. Once more, after advancing the working another mile and a half fire broke out again and the mine was abandoned, this time for good.

Reports on the area include a preliminary study by J.S. Stewart of the Geological Survey (not published); a report by J. MacVicar for a private company; a report by J.A. Allan and R.L. Rutherford, Department of Geology, University of Alberta, Research Council of Alberta publication Report #6 - 1923 and finally the area was carefully mapped by Dr. B.R. MacKay of the Geological Survey and the map published without a report. His findings were summed up in a paper in the Transactions of the Canadian Institute of Mining and Metallurgy for 1930. He was responsible for the new nomenclature, a Nikanassin formation, Cadomin conglomerate, Luscar formation and Mountain Park formation.

LOWER CRETACEOUS STRATA OF THE CADOMIN AREA

G. B. Mellon
Research Council of Alberta

Introduction:

The Lower Cretaceous rocks of the Cadomin area include the lower part of the Blackstone formation; the Mountain Park, Luscar, and Cadomin "formations", which together constitute the Blairmore group; and at least the upper part of the Nikanassin formation. These strata are exposed along a railway cut at Cadomin townsite, but the presence of covered intervals, coupled with much local folding and faulting, makes precise thickness determinations difficult.

The Blackstone Formation:

That part of the Blackstone formation between the Inoceramus labiatus or "Second White Specks" zone and the top of the Blairmore group is at least 600 feet thick at Cadomin, in contrast to its complete absence at Coleman in southern Alberta, and a thickness of 200 to 300 feet in the area between the Sheep and Ram Rivers. The interval consists largely of dark grey silty shale, with several zones comprised of thin, ripple-marked, micro-cross-laminated beds of grey, quartzose siltstone and silty sandstone. Ironstone nodules containing well-preserved specimens of Inoceramus corpulentus and rare casts of Dunveganoceras sp., both characteristic of the lower Kaskapau faunas of the Peace River area, are found in the upper part of this interval at Cadomin.

Megafossils are very rare or absent in the lowermost part of the Blackstone formation, except for scattered occurrences of fish scales, which are particularly abundant in a thin sandy member just above the base of the formation. If this horizon is correlative with the "Fish Scale Sand" of the sub-surface plains area, it marks the division between the Upper and Lower Cretaceous strata at Cadomin.

As is the case throughout the length of the southern and central foothills, the contact between the Blackstone marine shales and the underlying green, continental shales and siltstones of the Blairmore group is very sharp but conformable at Cadomin.

The Blairmore Group:

The Blairmore group at Cadomin can be divided into two distinct petrographic-lithologic units that are traceable as mappable formations along the length of the southern and central foothills. The base of the lower unit is defined by the Cadomin conglomerate member, composed of variable proportions of quartzite, chert, and siliceous argillite or slate pebbles, set in a coarse sandy matrix, and cemented by authigenic quartz and kaslinite. The member is about 20 feet thick at Cadomin, and is

overlain by a succession of well-cemented, fine-grained, grey sandstones and siltstones, and dark grey to black, silty, carbonaceous shales several hundred feet thick.

The individual sandstone members are up to 30 feet thick, and are invariably cross-bedded and well-sorted. They are composed largely of siliceous detritus in the form of quartz, quartzite fragments, and chert, with a lesser proportion of fine-grained siliceous and micaceous sedimentary and metasedimentary rock fragments. Clastic carbonate grains, derived from the erosion of pre-existing limestones and dolomites, are common in the finer-grained sandstones and siltstones. Authigenic quartz and calcite are the common cementing agents.

The shales are predominantly laminated, silty rocks, often with abundant leaf impressions of non-dicotyledonous plants, such as ferns, cycads, ginkgos, and conifers. These plant-bearing shales are associated with thin, non-commercial coal seams from a few inches to 2 feet in thickness, and scattered, thin nodular layers of clay-ironstone. X-ray diffraction analysis of similar shales from the Lower Blairmore formation of southern Alberta shows that they are composed of very fine-grained quartz, micromicas of the illite-sericite group, and kaolinite.

The top of the exposed Lower Blairmore sequence at Cadomin is marked by about 15 feet of dark grey, blocky shale containing abundant arenaceous foraminifera. A thin pelecypod coquina layer marks the base of this marine member, and is underlain in turn by laminated silty shales with abundant ostracodes. Small pelecypods and ostracodes also occur at the base of a similar dark grey, silty shale unit about 75 feet below the base of the marine shale member.

The marine shale member is probably correlative with the Glauconite sand horizon of the Mannville group in the Edmonton area, and with the ostracode-bearing limestones of the southern foothills.

The upper part of the Blairmore group at Cadomin is separated from the marine shale member by a covered interval 400 feet thick (as measured horizontally along the railway track). The base of upper sequence is marked by a pale grey, brown-speckled, fine-grained, non-calcareous sandstone member, characterized by good sorting and large scale cross-bedding. The sandstone contains up to 15 per cent plagioclase feldspar and siliceous volcanic rock fragments, and is approximately correlative with the "Home sand" horizon of Turner Valley. It is overlain by the coal seam formerly mined at Cadomin.

Exposures between the Home sand and the top of the Blairmore group are poorly exposed, but are sufficient to demonstrate the gradual gradation from the grey, slightly feldspathic sandstones and coal seams of the Home sand horizon to the green, barren sandstones of the Mountain Park "formation" at the top of the group. The color change is a function of the amount of volcanic detritus

and authigenic chlorite, the proportions of both constituents increasing towards the top of the Blairmore group. Thus, the Mountain Park sandstone member here consists of 2 green, predominantly medium-grained, cross-bedded sandstone members, separated by a partially covered dark grey, plant-bearing shale unit several feet thick. In thin sections, the sandstone consists of a high proportion of plagioclase and potash feldspar, fine-grained volcanic and metamorphic rock fragments, and volcanic biotite, with lesser proportions of quartz and chert. The cementing minerals are green fibrous chlorite, quartz, and calcite.

From 25 to 50 feet of interbedded dark green shales and siltstones, carrying a primitive, non-dicotyledonous flora similar to that from the non-feldspathic sandstones and shales beneath the marine shale member, separate the Mountain Park sandstone member from the overlying Blackstone formation. The total thickness of the upper Blairmore sequence above the marine shale member is estimated to be from 1500 to 2500 feet thick.

It is worthwhile to comment on some of the correlation problems involving the Blairmore group of the foothills, as exemplified by the section at Cadomin. For example, the division of the Blairmore group in the Cadomin area into the coal-bearing Luscar and barren Mountain Park formations, respectively, is vague and difficult to extend outside the type area. The reason is that the change from the coal-bearing sequence above the marine shale member to the overlying green, barren Mountain Park sandstones and shales is completely gradational, and inconsistent from one area to the next.

A more meaningful division of the Blairmore group at Cadomin is based upon the mineral composition of the sandstones, those of the upper unit above the marine shale member containing conspicuous amounts of feldspathic and volcanic detritus, whereas those of the lower unit contain none. Moreover, the amplitude of the cross-bedding in the upper unit is large compared to that observed in the non-feldspathic sandstones below the marine shale member. Using the petrographic criterion in particular, the two divisions of the Blairmore group described here can be traced along the length of the southern and central foothills.

However, apart from the petrographic and lithologic differences that distinguish the two divisions of the Blairmore group at Cadomin, both contain the same non-dicotyledonous flora. In contrast, the upper part of the Blairmore group in southern Alberta, including the Crowsnest volcanics, contains a distinctly different, predominantly dicotyledonous flora, and is petrographically distinct from the underlying green, chloritic sandstones that occur below the Blackstone at Cadomin. The absence of this dicotyledon-bearing series at Cadomin, through erosion or non-deposition, suggests an unconformity here at the top of the Blairmore group of considerable magnitude.

The Nikanassin Formation:

The lower part of the Nikanassin formation is well exposed along the gorge of the McLeod River between Cadomin and Mountain Park. Here, the dark grey marine shales of the Fernie formation gradually grade up into a succession of thin-bedded, ripple-marked, cross-bedded fine-grained sandstones and siltstones, and dark grey, silty, micromicaceous shales similar to the "passage beds" of the southern Alberta foothills. However, where the presence of a prominent basal sandstone member and numerous coal seams help to clearly define the Kootenay coal measures from the underlying "passage beds" of the Fernie formation in the south, their absence in the Cadomin-Mountain Park area makes the boundary there gradational and quite arbitrary.

The remainder of the Nikanassin formation above the transitional zone consists of a monotonous sequence of cross-bedded, grey, fine-grained sandstone and dark grey, silty shale units up to 20 or 30 feet thick. The rocks are very similar in gross appearance and mineral composition to those that constitute the lower part of the Blairmore group, except that the hard, siliceous sandstones of the Nikanassin formation are more micaceous and rarely calcareous. In fact, without the ubiquitous Cadomin conglomerate member at the base of the Blairmore group, it would be very difficult to distinguish between the two formations using lithologic and megascopic petrographic criteria alone.

The upper beds of the Nikanassin formation include several thin coal or carbonaceous shale beds, which carry a flora similar to that of the Kootenay formation of southern Alberta, confirming the stratigraphic break at the base of the Blairmore group suggested by the Cadomin conglomerate. Apart from the few plant remains, however, megafossils are absent from the Nikanassin formation at Cadomin, excepting scattered, comminuted pelecypod fragments in the lower part of the sequence.

THE CADOMIN CAVES: A NOTE

R.S. Taylor
Dept. of Geology, U. of A.

Older residents of Cadomin believe the caves were known as early as the twenties, but the information was never widely disseminated. The caves became a matter of public knowledge in June 1959, and a reservation was placed on the land enclosing them by the Dept. of Lands and Forests.

The entrance of the main cave system lies about 1½ miles SSW of Cadomin Station (G.S.C. Map 209A: Cadomin Sheet), on the N side of the NE-trending spur across the McLeod River and immediately W of the Inland Cement Company's quarry. This land is unsurveyed, but the entrance probably lies in Lsd. 15-25-46-24W5th. A reverse talus slope, spilling into the cave, stands 10 feet above, and conceals, the cave mouth from all but a few points of superior elevation. The entrance is 6170 ft. above MSL., and lies 250 ft. below the center of the second saddle in the spur (as counted from the valley). Only one entrance is known.

The main gallery of this system was surveyed in July by Prof. W. L. Bigg (Dept. Civil Eng., U. of A.) and myself, for the Dept. of Lands and Forests. This gallery has a slope length of 870 ft., and drops 210 ft. between its entrance and the closed lower end; it averages 20 X 12 ft. in width and height. A passageway leading off the lower end of the main gallery permits one to penetrate an additional 400 ft. into the mountain.* In following this route, one passes through the Mess Hall, the largest chamber found. It is approximately 75 X 150 ft., and averages 30 ft. in height. In all, about 1300 additional feet of side and interconnected passageways have been delineated by various people. Not all of the smaller passageways have been explored to their ends; thus the total extent of this system is not yet known.

Three smaller caves (maximum known length about 100 ft.) have been found on the dip (S.) slope of the spur, about ½ mile ESE of the entrance of the main cave system. No interconnections between these smaller caves and the main system are indicated.

According to MacKay's map (G.S.C. Map 209A), all these caves lie in upper Devonian limestone (Palliser). This limestone, underlain by a thrust, has a strike locally variable from NW to WNW, with dips of 18-30°. The trend of the caves is 140° T., and the plunge of the main gallery averages 13° in this direction. Thus, the length of the system is not down-dip, but closer to the strike direction.

The caves exhibit features attributed to solution activity in both the phreatic and vadose zones, and they have also undergone an episode of filling by clayey silt. Commonly, the floors of the main cave system are covered by large angular boulders of many tons' weight. Fortunately, the cave silt still mantles most

of these boulders, else footing would be more precarious. The silt, however, is presently in the process of being removed by sub-surface water, and the layer of boulders is revealed to be 20 ft. deep in places.

There is little spectacular in the way of cave "formations" of secondary $CaCO_3$. Dripstone forms are of small size: the largest stalagmite found is a bit over 12 X 18 inches; the largest stalactite seen is somewhat smaller. Draperies (Pendant blade - or ribbon-like forms) are more common, especially on the deeper, sloping ceilings. Flowstone coats some of the cave walls and in places is composed of several layers. This is especially true of the deepest part of the system.

The age of the caves is still a matter of conjecture. The fact that they are oriented across the dip, rather than down-dip, raises the question of whether they are at all related to the present attitude of the limestone. With the thick layer of caved boulders on the floors (and with no indication of recent rock fall), and with both dripstone and flowstone fragments apparently incorporated in the floor mantle of boulders and silt, it seems possible that the caves antedate the tectonic movements resulting in the present attitude of the host limestone.

* My thanks are due F. M. Connelly, J. Huston, and J. F. Pecover for information permitting a more complete picture of the cave complex to be drawn. Despite three trips to the caves, I have not yet been through all known passageways.

ECONOMIC GEOLOGY

G. Peterson
Geologist - Imperial Oil Company

LIMESTONE

Limestone is being quarried at Cadomin from the Palliser formation. The quarry is situated on the first thrust that brings up Devonian strata in the Nikanassin range. Right at the quarry Palliser limestone is thrust onto Fernie shales.

Operations started in the fall of 1954 and an average output of limestone quarried is 56,000 tons a month. This average is on a yearly basis. However, the production drops sharply in the severe winter months due mainly to the difficulty of unloading the crushed limestone when it arrives in Edmonton.

The rock is crushed to six inches maximum diameter and shipped to the Inland Cement Plant in Edmonton. Here it is mixed with clay which is high in aluminum and silica. There is a 150 year supply of clay right at the plant site. Iron is obtained from the tailings of the Sherritt Gordon plant at Fort Saskatchewan and added as a flux. These constituents, fused together, make a clinker. This clinker is ground with the addition of 4% gypsum which is added as a retarding agent for setting. The final product is called an hydraulic or Portland cement. The amount of MgO permissible in the final product is 4%. Thus 5 - 5½% in the original limestone can be tolerated. The limestone, being quarried at Cadomin, has about 2½% magnesium.

OIL & GAS

There are two wells in the Cadomin area which have commercial gas. The B.A. Triad et al Mt. Park well in Lsd. #5, Section 36, Township 47, Range 22, W5 Meridian, had a 13,000 Mcf/day flow of gas from the middle dolomite unit of the Sulfur Mountain member. The reserves on this well have been calculated at 23.5 billion cubic feet of gas per section.

The Lovett River well in Lsd. 12, Section 30, Township 46, Range 18, W5 Meridian, has a total net pay of 212' from three slices of Mississippian strata and one Nordegg horizon. The average porosity is 5%. The reserves calculated for this well is 28.3 billion cubic feet per section.

COAL

The coal areas can be divided into the inner and outer foothills coal areas. The inner foothills production has come from the Lower Cretaceous Luscar formation. Three mines (shut down at present) located at Mt. Park, Cadomin and Luscar produced all the coal in this area. Mt. Park (1911-1950) has 8 seams of coal aggregating 77' over a 1200' interval. Cadomin (1917-1952) has one seam 22 - 25' thick, which is located 700' above the Cadomin conglomerate. Luscar (1921-1957) has 4 coal seams aggregating 155' in an 800' interval. The coal in this area is medium to low volatile bituminous

coal. Production figures for the area for 1938, maximum production in 1949 and production in 1953 from the Luscar mine are given below.

1938 - 688,000 tons
1949 - 1,128,000 tons
1953 - 482,000 tons

The estimated reserve of this area is 5,200 million tons.

The outer foothills coal area, which includes mines at Mercoal, Coalspur, Sterco-Foothills and Robb, produced coal from Upper Cretaceous and Tertiary strata.

Mercoal (1920 - 1959) produced coal from two coal seams in the Tertiary strata. The #1 seam is 7' thick and #2 seam is 10' thick.

The coal is bituminous, high volatile, C-non coking coal. Production for this area for 1938, 1946 (maximum production) and 1953 is as follows:

1938 - 350,000 tons
1946 - 830,000 tons
1953 - 636,000 tons

The estimated reserves of this area are 3,600 million tons.

APPENDIX

MEASURED SECTIONS

Wapiabi Transition Zone - Solomon Sandstone

Ralph L. Rutherford - Alta. Geol. Survey Rept #11

The Section is given below as exposed on McLeod river in sections 22 and 27, township 47, range 23, indicates the relation of the thick conglomerate in the Saunders to the base of the formation, and the relation of the Saunders and Wapiabi formations.

	Thickness in Feet
Sandstones and shales, alternating beds averaging 10 to 15 feet in thickness	4,000
Conglomerate, massive (Plate 5,A)	75
Clay shales, ribboned with thin sandstone bands	60
Sandstone, with lenses of pebbles, grey cross-bedded, thin shale layers	30
Clay shales, with thin bands of sandstone	185
Clay shales, with sandstone bands up to 5 feet thick. Some plant remains	210
Clay Shales, with few arenaceous bands	50
Shales, black-ribboned with thin sandstone lamellae. Look like marine deposits	50
Sandstone, hard, massive, fine grained, shaly towards the top (Plate 4,B)	80

Upper Concretionary Shale Zone below

Cardium Formation

Road Log Committee

Location: Sec. 30-Twp. 47-Rge. 22-W5thM

	Thickness
Grit, brown, weathering brown, shaly in lower 4'	9'
Sandstone, light grey, fine grained, hard, minor shale breaks, ripple marks	36'6"
Shale, dark grey, silty	9'
Sandstone	1'
Sandstone and shale interbedded	4'10"
Sandy shale	12' 9"
Shale, dark grey, chunky, occasional thin sandstone beds	111'
Sandstone, grey, brown weathering, fine grained, plant remains	4'
Shale, dark grey, hackly weathering, sandstone interbeds	22'
Sandstone, grey, weathering brown, fine grained, thinly bedded, slightly cross-bedded, hard, carbonaceous, ripple marked	5'
Shale, dark grey, weathering brown, silty, ironstone nodules	4'
Sandstone, grey, weathering brown, quartzitic, thick bedded, very fine grained	6' 7"
Shale, dark grey	102'
Sandstone, grey, grey-brown weathering, very fine grained, hard, salt and pepper, thick bedded	34'

Fernie Group

Hans Frebold – G.S.C. Memoir 287

Good outcrops of the Fernie group occur in railway and road-cuts between Cadomin and Mountain Park.

Nikanassin formation (above)	Thickness
Shale; dark, sandy; thin reddish brown bands of calcareous sandstones; plant remains and a few nondistinctive pelecypods: Younger than Middle Bajocian, probably representing Upper Jurassic. Similar rocks in Fiddle Creek, Snake Indian Valley and other localities in the same stratigraphic position. About	400'
Covered interval, probably shale as above. About	100–150'
Limestone; hard, sandy; many fossils (Stephanoceratids, belemnoids, Gryphaea cadominensis and others). Rock Creek member (sensu stricto) Middle Bajocian	6'4"
Shale and sandstones; concealed in part. About	33'
Sandy Limestone; hard, light grey; shell fragments	9'
Concealed interval About	50'
Sandstone; hard, dark grey; belemnoids	20'
Sandstone; dark grey, yellowish brown weathering; many tubes of various shapes originating from burrowing animals (worms ? and others)	11'4"
Shale; greenish grey	28'
Sandstone band	2'5"
Shale; greenish grey; small concretions	31'
Sandstone; hard, greenish grey; ripple-marks	26'
Concealed: thickness unknown (about 100 feet); probably shale and sandstone	?
Sandstones and shale alternating; belemnoids, tracks, plant remains (estimated)	75–100'
Base of Rock creek member (Middle Bajocian) Shale; dark platy; Harpoceras, belemnoids. Toarcian	75'
Limestone; cherty, Nordegg member (Sinemurian). The "Oxytoma bed", found at other localities on top of the Nordegg member, was not observed at this locality.	50'

Whitehorse formation of the Triassic.

SPRAY RIVER FORMATION

Dr. E. W. Best, Triad Oil Co., Calgary

Whitehorse Member

Location: McKenzie Cr. Sec. 19, Twp. 46, Rge. 22, W.5M

	Thickness
Quartzite, dolomitic and siliceous cement, light grey, medium grained, well sorted and rounded, uniform, minor carbonaceous flecks, blocky light grey weathering	17' 5"
Dolomite, slightly argillaceous, light grey, very fine grained, dense in 1' beds with 3" shaly sandstone interbeds (20%) . . .	4' 11"
Dolomite, argillaceous, sandstone streaks, (10%), light bluish grey, very fine grained, dense, tends to nodular weathering .	1' 8"
Dolomite, some fine sand, medium bluish grey, very fine grained, dense, hard uniform	8"
Dolomite, argillaceous, medium bluish grey, very fine grained, dense, slightly nodular and blocky weathering	1' 6"
Dolomite, light brown, sublithographic, uniform, dense	2' 6"
Dolomite, sandstone (30%), light grey, very fine grained, dense, irregular wavy streaks of medium grained sandstone, some floating sand grains, in 2' even beds	5' 2"
Dolomite, light grey, very fine grained, dense, uniform, evenly bedded	4' 5"
Dolomite, sandy (5%), light grey, very fine grained, chalky, dense, streaks and bands of fine grained sandstone	9' 10"
Sandstone, very dolomitic, fine to medium grained, in rusty weathering thin wavy beds	21' 3"
Dolomite, light brown, very fine grained to sublithographic, dense, hard, banded, in slightly irregular wavy beds	3' 6"
Dolomite, 20% sandy bands, light grey, very fine grained, dense uniform, massive	2' 4"
Dolomite, as above with no sand	3' 5"
Dolomite, likely calcareous, light brown, fine grained, crystalline banded, in one massive light brown weathering bed . . .	2' 6"
Dolomite, slightly sandy, light grey, very fine grained dense, soft, banded, in three even beds	3' 6"
Dolomite, greyish white, very fine grained, chalky, dense in 1' even beds	3' 8"
Dolomite, slightly calcareous, light greyish brown, fine grained, crystalline, sometimes chalky, in part recrystallized, abundant 1" vugs, in a very massive light to medium grey weathering bed. The upper part becomes very fine grained, earthy and with fewer vugs	19' 7"
Dolomite, slightly calcareous, greyish white, very fine grained, chalky, soft, slightly banded, in 1" beds	1' 10"

	Thickness
Dolomite, calcareous, light brown and grey banded, fine grained, crystalline, friable, intergranular and some vugular porosity, wavy banded, bed partly brecciated and at times completely brecciated, in massive irregular beds which tend to break into smaller wavy beds	31' 1"
Covered	106' 2"
Dolomite, medium bluish grey, very fine grained, dense, light brown weathering, thinly bedded at the top	14' 4"
Covered	17' 5"
Dolomite, as above in 14'4"	2' 0"
Total Whitehorse Member	281' 7"

Sulphur Mountain Member

Unit C

	Thickness
Covered	2' 7"
Sandstone, slightly argillaceous, very slightly dolomitic, light bluish grey, very fine grained, dense, hard, uniform, carbonaceous flecks, sometimes cross-bedded, micaceous, in 2 to 3' bluish grey weathering, massive beds. Upwards becomes less argillaceous, more massive and lighter coloured.	57' 2"
Sandstone, argillaceous, very fine grained, dense, hard, in 3' massive brown weathering beds. FB 752.	43'
Siltstone, argillaceous, medium bluish grey, in massive 2' beds separated by 2" zones of thinly bedded argillaceous siltstone. The thinly bedded siltstone becomes very abundant upwards.	36'
Covered. In part thinly bedded siltstone	4' 1"
Sandstone and siltstone. 8" to 1' beds of fine grained, massive, dense, bluish grey, slightly argillaceous, micaceous sandstone separated by 4" zones of very thinly bedded, argillaceous, micaceous siltstone	11' 6"
Covered. Mostly thinly bedded, very fine grained sandstone .	2' 6"
Sandstone, very fine grained, medium bluish grey, massive, dense, uniform	3' 5"
Covered	77'
Sandstone, medium bluish grey, very fine grained, carbonaceous banding, micaceous, pyritic, in 1" even beds	4' 11"
Sandstone as above only more massively bedded	2'
Sandstone as above in 4' 11"	3' 4"
Covered. In part buff weathering, very dolomitic siltstone .	4'
Total Unit C	251' 6"

	Thickness
Unit B	
Dolomite, medium grey, fine grained, crystalline, scattered small vugs, some intercrystalline porosity, 25% mottles of fine grained, crystalline, light brown dolomite in 1 to 2' slabby light brown weathering beds. FB 751 . . .	13' 8"
Dolomite, medium grey, fine grained, crystalline, scattered small vugs, in 1 to 2' slabby light brown weathering beds	8' 3"
Total Unit B	21' 11"
Unit A	
Covered	33' 3"
Sandstone, slightly calcareous, bluish grey, very fine grained, dense, massive, a few <u>Lingula</u>, in 1' massive beds separated by $1\frac{1}{2}$' zones of thinly bedded sandstone. FB 750.	6' 10"
The remainder of this section is reddish brown weathering, unless otherwise stated.	
Sandstone, bluish grey, very fine grained, hard, dense, uniform, in $\frac{1}{4}$" beds	10'
Sandstone, bluish grey, very fine grained, slightly crystalline, dense, massive, in 1' beds	2' 9"
Covered	1'
Sandstone, bluish grey, fine grained, massive, dense	2' 3"
Sandstone, very fine grained, in $\frac{1}{4}$" wavy beds	1'
Covered	6"
Sandstone, bluish grey, fine grained, massive, dense, in 2 to 3' brown weathering beds which become thinner bedded upwards .	10' 1"
Covered. In part thinly bedded, sandstone	10' 2"
Sandstone, very fine grained, crossbedded, carbonaceous banding, in two massive beds	4' 4"
Siltstone, slightly argillaceous, thinly bedded, with the occasional 2" even, very fine grained sandstone bed	2' 5"
Sandstone, bluish grey, very fine grained to fine grained, dense, massive, some channeling at the base	4' 1"
Sandstone, very fine grained, dense, banded, in massive 8" even beds	3'
Siltstone, grey, thinly bedded	1'
Sandstone, medium bluish grey, fine grained, massive, dense, micaceous, carbonaceous banding, in two even beds	1' 2"
Siltstone, grey, papery thin beds with the occasional 1 to 3" very fine grained, massive sandstone bed	4'
Sandstone, medium bluish grey, very fine grained, massive, dense, in 8" beds with a few thin siltstone beds	6'
Siltstone and sandstone. Thinly bedded, argillaceous, medium brown, banded siltstone with the occasional thicker bedded, very fine grained, massive sandstone bed	2' 11"
Sandstone, medium bluish grey, very fine grained, massive, dense	11"

	Thickness
Siltstone and sandstone as above in 2' 11"	5' 2"
Shale and sandstone. 6" bed of silty, medium bluish grey, flakey shale separated by very thin, very fine grained, dense sandstone beds	3' 8"
Shale and sandstone as above, sandstone in 2 to 3" beds	3' 8"
Sandstone, very minor argillaceous matrix, medium bluish grey, fine grained to very fine grained, micro-pyritic, uniform, in massive 2 to 3' beds separated by 3" zones of thinly bedded siltstone with minor carbonaceous bands . .	2' 1"
Shale and sandstone. Shale 8 to 10" bed of medium grey, micaceous, flakey shale, separated by 1" beds of very fine grained banded argillaceous sandstone	5' 11"
Sandstone and siltstone, 2 to 3' beds of fine grained to very fine grained, slightly argillaceous, medium bluish grey, micro-pyritic, massive uniform sandstone separated by 3" beds of siltstone with carbonaceous banding	28'
Sandstone, slightly argillaceous, medium bluish grey, very fine grained, dense, in 1' even brown weathering beds . . .	8' 10"
Sandstone, medium grey, very fine grained, dense, carbonaceous bands, in even 3" beds separated by 2 to 3" zones of very thinly bedded, slightly wavy, slightly argillaceous sandstone	10' 3"
Covered	4'
Sandstone as above in 10'3"	11' 10"
Sandstone as above in 10'3", sandstone in $\frac{3}{4}$" beds separated by 5" thinly bedded zones	15' 8"
Siltstone, slightly argillaceous, light brown, in $\frac{1}{4}$" wavy beds with the occasional $1\frac{1}{2}$" even, hard, massive, very fine grained sandstone bed	19'
Siltstone, slightly argillaceous, light brown, carbonaceous flecks, in papery thin beds with the occasional $\frac{1}{2}$" more massive even bed of dense siltstone	22' 4"
Covered	6"
Total Unit A	253' 1"
Total Sulphur Mountain Member	526' 6"

Mississippian

Road Log Committee

Location: Sec. 19-Twp. 46-Rge. 23-W5thM

Mt. Head Formation 265'	Thickness in feet
Dolomite; light brown-grey weathering, grey and grey-brown, microcrystalline, trace to 20% chert in lenses.	50
Dolomite; buff-grey weathering, blue-grey, finely crystalline, thick well bedded, brown limonite specks due to weathered pyrite, 10% green shale in 2" bands between dolomite beds, tight.	10
Dolomite; light grey weathering, light grey, grey and grey-brown, microcrystalline, massive, top 40' has occasional thin shale bed. Occasional poor vuggy porosity.	98
Covered.	10
Dolomite; light grey weathering, grey-brown, microcrystalline, thick bedded, a few calcite infilled fractures and vugs, tight.	5
Covered:	10
Dolomite; grey and light grey, microcrystalline, calcareous, poor leached vuggy porosity, 10% reddish-brown chert in 1/2" - 2" beds in top 10'.	20
Dolomite; light grey weathering, grey, fine crystalline, good bedding varying from thick bedded at top to thin at bottom, tight.	9
Shale; maroon, very dolomitic, thinly bedded.	2
Dolomite; light grey weathering, grey and grey-brown, microcrystalline, occasional thin shale bed throughout, tight.	51

Turner Valley Formation 180'

Dolomite, grey, finely crystalline, 305'-335' has 20% grey and brown chert in lenses and blebs, massive, occasional poor porosity.	130
Dolomite; grey and grey-brown, fine to medium crystalline, thick bedded, 20' fair porosity, 10' poor porosity.	50

Shunda Formation 299'

Covered	13

Dolomite; grey weathering, grey-brown, finely crystalline, 1'. bed of skeletal limestone in centre.	4
Shale; grey, calcareous.	1
Covered.	5
Dolomite; buff-grey, finely crystalline, thick bedded, a few calcite infilled fractures, poor surface porosity.	10
Covered.	95
Limestone; light grey, medium grained, thin bedded, argillaceous.	2
Covered.	32
Dolomite; grey and grey-brown, finely crystalline, argillaceous, tight.	50
Limestone; grey and brown, medium grained.	27
Covered.	8
Shale; dark grey.	2
Dolomite; grey weathering, dark brown, finely crystalline, tight.	2
Shale; calcareous.	2
Dolomite; buff weathering, grey-brown, microcrystalline, massive.	8
Limestone; buff weathering, grey, microcrystalline, thick bedded, slightly argillaceous.	4
Dolomite; grey weathering, grey and brown, microcrystalline, highly fractured, some breccias.	34

<u>Pekisko Formation 115'</u>

Dolomite; light grey and grey weathering, light grey and grey-brown, microcrystalline, massive, surface leached porosity.	60
Dolomite; light grey weathering, light grey and various shades of brown, medium crystalline, massive.	55

<u>Banff Formation 573'</u>

Dolomite; buff weathering, grey-brown, finely crystalline, silty, thin well bedded, specks of limonite, tight. Partly covered.	63

Limestone; grey medium and micro grained, thick bedded argillaceous. Partly covered. 39

Limestone; dark grey weathered, brown, coarse grained with fine grained matrix, thin bedded, 30% skeletal (crinoids and cup corals), tight. 10

Dolomite; dark brown, medium grained, thick bedded, calcareous and argillaceous, 20% crinoids, tight. 6

Covered. 4

Limestone; brown, coarse grained, with fine grained matrix, thin bedded, with 40% crinoids, and brachiopods, slightly argillaceous. 10

Limestone; grey weatherin., brown, micro to medium grained, trace chert near base. 18

Shale; grey weathering, light grey-brown, thin bedded, calcareous, limonite staining. 4

Limestone; grey and grey-brown, micro and medium grained, argillaceous, 60% crinoids in top part. 14

Dolomite; grey, micro to medium crystalline, 20% skeletal. Partly covered. 30

Shale; 70% and Limestone; interbedded.
Limestone; dark grey weathering, brown, microcrystalline, thin bedded, argillaceous.
Shale; dark grey, thin bedded, calcareous. 133

Shale; dark grey weathering, dark grey-brown, calcareous, with some calcite veinlets, trace of limestone nodules. 30

Shale - 65%, Limestone - 35%, interbedded.
Shale; dark grey weathering, grey-brown, calcareous, thin bedded.
Limestone; buff weathering, brown, fine grained, argillaceous, thin bedded. 190

Shale; grey weathering, dark grey, calcareous, thin bedded, some with conchoidal fracture rather than platy. 10

Covered. 12

<u>Palliser Formation</u>

Limestone; dark grey, fine grained, with poor lenticular thin bedding, 20% chert nodules and lenses, fossiliferous. 15

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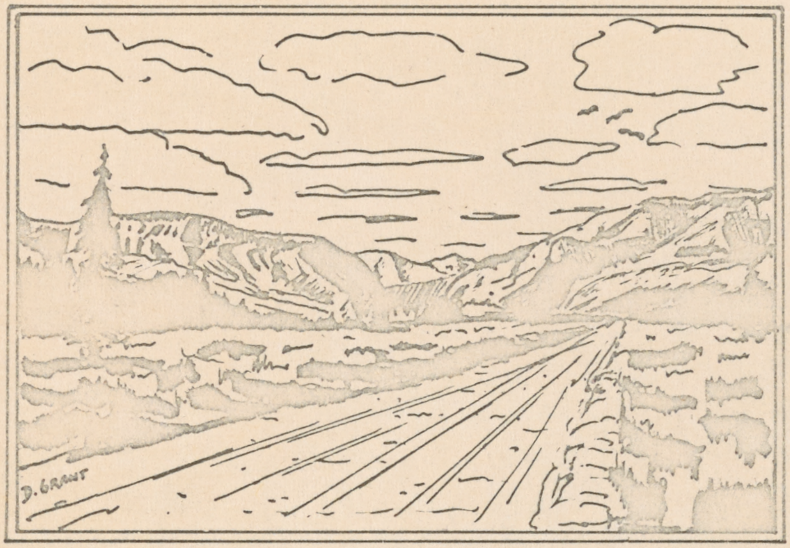

CADOMIN AREA